

## NEW MOLLUSCAN GENERA FROM THE CARBONIFEROUS.<sup>a</sup>

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Among the Carboniferous faunas examined in the course of investigations connected with official work, I have been led to recognize a large number of undescribed species and some genera, which in most cases it did not seem appropriate to make known in connection with the studies that brought them into notice. Many of these types were laid aside for discussion with one or another of a number of subjects the investigation of which is projected. There remains, however, a collection very miscellaneous in character and not germane to any of the papers now in view. A few of the generic types it is here proposed to describe and name.

In order to secure brevity in the title of this paper, the term molluscan is employed in a somewhat broader sense than present usage generally sanctions, though not inconsistently with that of the last generation by which brachiopoda were grouped with the true mollusca.

The fossils upon which the observations recorded in this paper were made form part of the collections of the U. S. National Museum.

### LIMIPECTEN,<sup>b</sup> new genus.

It is rare that one is able directly to observe structural characters in Carboniferous Pectinoids. Usually either the shell is embedded in hard rock, from which it is hopeless to clear it, or else, and this is the best that happens, the test has been dissolved away and the structures are seen in reverse as casts. A few examples from Young County, Texas, however, which have recently come under my observation, though more or less fragmentary, retain their original shell substance completely and show characters which indicate that they are distinct from any of the genera thus far defined. I will first describe this form, which seems to belong to a new species as well as to an unknown genus, in detail, and then consider the characters by which it is distinct from related genera.

Genotype.—*Limipecten texanus*.

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<sup>b</sup>From *Lima* and *Pecten*, two Pelecypod genera.

## LIMIPECTEN TEXANUS, new species.

Plate XLV, figs. 1, 2, 3; Plate XLVI, fig. 4 (?); Plate XLVII, figs. 1, 2, 3.

Shell large; length nearly equal to or slightly in excess of the width. The largest example observed must have been over 65 mm. long when complete. The hinge line is long, though somewhat shorter than the greatest width. The obliquity is slight but appears to be forward as in *Lima*.

The convexity of the left valve is moderate or strong in different individuals. The umbo is large, well defined, and incurved. The wings are broad and the outline is not strongly withdrawn beneath them. They are of nearly equal size, the anterior one being possibly a trifle larger than the posterior. It is also much more strongly defined, for while the posterior wing is depressed and slightly upturned, and therefore bounded by an ill-defined groove, the descent to the anterior wing is abrupt and angular. This wing is flattened and somewhat oblique. The surface is crossed by rather coarse and radiating ribs, which are more or less regularly unequal in size. Frequently three gradations can be distinguished, every fourth rib being large, those half way between somewhat smaller, while others alternating with these two systems are still smaller. The ribs do not extend onto the wings, though sometimes traces of slender ones appear. The surface is also crossed by delicate concentric lamellæ, rather distant and irregular, which are much stronger and more crowded on and near the wings. They cross the shell in scalloped lines with pointed extensions in the striæ between the ribs.

The right valve is much flatter than the left and its surface ornamentation, though of the same general character, is so different that one would hardly think of the two belonging together, if found separately. The posterior wing is flat, and not marked off from the rest of the shell. The anterior wing is, on the other hand, sharply defined, and the outline is strongly retracted beneath so as to make a deep byssal sinus. While the umbo of the left valve is prominent and well defined, the right valve practically lacks this feature altogether. The surface is marked by somewhat depressed ribs, which are much finer and more numerous than those of the opposite valve. They are, as a rule, obsolete over and near the wings, but a few faint and slender ones can sometimes be seen. The concentric lamellæ are in like manner finer and fainter than those of the left valve. They are obscure over most of the shell, and only distinct upon and near the wings.

There is a broad and massive hinge plate marked by structural lines parallel to the straight lower border, and just beneath the beaks a large distinct fossette for the resilium which is very oblique and directed backward. Both valves seem to have this structure of the same character and force. Near the center, under the hinge plate, are

several small depressions arranged in a row, and some distance apart, which may mark the position of the pedal muscle.

The shell is thick and massive, especially in the upper and older portion. It is conspicuously constructed of two layers, an outer one which is relatively thin and which carries all the more delicate surface ornamentation, and an inner which is much thicker and receives only the strong plications. The inner layer consists of laminae approximately parallel to the surface. Because of the distinct demarcation of the outer layer I suspected that it might have a prismatic structure. Though in one or two instances fine parallel lines were thought to be observed running across this layer on broken surfaces, no prismatic structure is shown by thin sections. These indicate, however, that the outer layer had a distinct composition of its own, for it is defined by a sharp line from the massive inner portion, and is, furthermore, nearly transparent, while the other transmits light but imperfectly. The fact that in its present condition the outer layer is transparent and structureless inspires and leaves room for conjecture as to what may have been its original arrangement.

This species, while presenting some resemblance to *Ariculipecten providensis* Cox, is distinct both from it and from every other American form known to me. The shape of the Texan species is somewhat different from that described by Cox, being broader at the hinge line. Furthermore, his description, as well as his figure, indicates that the main ribs are subdivided by longitudinal striae into riblets. Nothing of this sort occurs in *Limipecten texanus*, the concentric lamellae of which, on the other hand, are not mentioned as occurring in *Ariculipecten providensis*.

Cat. No. 27102, U.S.N.M.

*Locality and horizon.*—Pennsylvanian (Cisco), Graham, Young County, Texas.

**LIMIPECTEN TEXANUS** var. **GRANDICOSTATUS**, new variety.

Plate XLVI, figs. 1, 2, 3.

It is necessary also to distinguish a variety of the species above described, which differs in having larger and less numerous ribs upon the left valve. Otherwise in all its structure and ornamentation the coarsely plicated shell resembles *Limipecten texanus*.

Cat. No. 27103, U.S.N.M.

*Locality and horizon.*—Pennsylvanian (Cisco), Graham, Young County, Texas.

Before considering the characters which seem to distinguish this species generically, a better judgement will be formed by taking a survey of certain other forms probably congeneric with it.

The structure of the hinge plate, so well shown by the Texan form, seems to be a more important character than minor differences in con-

figuration, and relying especially upon it some three other species can probably be referred to *Limipecten*, though I suspect that a larger number of those now grouped with *Ariculipecten* really belong there. Prominent among the species assigned to *Limipecten* is *Ariculipecten occidentalis* Shumard, the commonest Pennsylvanian Pectinoid of the Mississippi Valley region. The structure of the hinge plate in this species was known and described by Meek as long ago as 1866, but he did not see fit to separate it from *Ariculipecten*, though, if the latter really has the structures universally ascribed to it, I do not see how these shells can be consistently grouped together. Meek's remarks upon this point are as follows:<sup>a</sup>

In good casts of the area of this species, we have observed unmistakable evidences of a very shallow, flattened, trigonal cartilage pit. It is unlike that of Peeten, however, being quite broad, distinctly triangular and very oblique, more as we see in *Meleagrina*. It is traversed by the same fine striae that mark other parts of the area. One of the most important distinctions between this genus, as generally understood, and all of the modern type of the *Pectinidae*, is the presence of a distinct, well-defined cartilage pit in the hinge of the latter. The species under consideration, however, shows that there was, sometimes at least, a slight tendency to form a similar cartilage depression in the area of *Ariculopecten*, thus furnishing another evidence of the imperceptible gradations by which all groups will probably be found linked together when we can have an opportunity to compare very large numbers of the living and extinct types.

My own observations upon this species were independently made upon some external and internal casts from Saline County, Illinois. The specimens were sent by A. H. Worthen, and identified by him as *Ariculipecten cleavelandicus*. It was possibly upon fossils from this lot that the recorded observations of Meek were made. It will be remembered that *A. cleavelandicus* was placed by Meek in the synonymy of *L. occidentalis*, and the specimens from Illinois appear to be the form currently identified with Shumard's species. The hinge plate and cartilage pit in these specimens are the same as in *Limipecten texanus*, and I feel little doubt that they belong to the same genus. Thin sections of a shell from Afton, Union County, Iowa, supposed to belong to *L. occidentalis* show tubular structure very clearly, the tubules being remarkably large and scattered. This section seems to show only a single layer, which I would take to be the outer one if two were actually present. To harmonize this observation with that made upon *Limipecten texanus* it will be necessary to note that in the case of *Limipecten occidentalis* the section was taken near the ventral margin of a young or small example, while in the case of *Limipecten texanus* the section was taken near the hinge margin of a large old specimen. It is a probable hypothesis that the lamellose (nacreous?) inner layer of *Limipecten texanus* would be very thin, or even absent, near the margin of the shell, so that what appears to be a single homogeneous layer in

<sup>a</sup>Geol. Survey Illinois, Report, II, 1866, p. 331.

*Limipecten occidentalis* represents the thin external layer whose structure in the slides of *L. texanus* had been obliterated. If these observations are correctly correlated, the presence in these shells of an inner lamellose, probably nacreous layer, and of an outer tubulous layer, is important in ascertaining their relationship with other genera.

Another form in which the hinge structure characteristic of *Limipecten* has been observed seems to be as yet undescribed. It was found near Topeka, Kansas, and is allied to *L. occidentalis*, from which it is distinguished chiefly by its large flat ribs. No new facts are added by observations made upon this species.

The third and last form, supposed to show the hinge structure of *Limipecten*, is a species identified by De Koninck with *Ariculipecten calatus* McCoy. His figure represents a hinge plate with a ligamental pit similar to that of *Limipecten*, and his description indicates a similar median structure, although the interpretation is certainly different.

All these shells are more or less nearly erect; but because imperfections in outline are frequent, and sometimes very misleading, it is seldom possible to tell confidently whether the axis is directed forward or backward. Both conditions seem to occur; and while in some cases this character may serve to discriminate species, I doubt if it can be applied to generic groups. In practice its utility for any rank of discrimination will of necessity be much limited. In my figures *Limipecten texanus* is represented as having a forward inclination, but I am not altogether satisfied as to the fact. The growth lines seem to indicate this shape, but the circumstance that the cartilage pit has a strong backward inclination may not be without significance.

Aside from the structure of the hinge plate, several features in the configuration and ornamentation of *Limipecten* are more or less striking. The inequivalve character of the shell is one of these. The right valve throughout the forms referred to *Limipecten* is not only very much flatter than the left, but has somewhat different and much fainter surface ornamentation. The wings are not always conspicuously unequal. If anything, the posterior one is larger than the anterior; this fact being determined by the distance from the point of the umbo to the extremity of the wing. In the typical species the anterior wing is strongly defined, and the posterior undefined, but while it seems to be a general truth that the demarcation of the anterior wing is more abrupt than that of the posterior, individual specimens can be found, as, for instance, in *L. occidentalis*, in which there is little if any difference, both wings being strongly outlined. In *L. texanus* the plications, faint over most of the shell, are practically obsolete on the wings, though traces of them were noticed in individual specimens. In *L. occidentalis*, a strongly radiate species, the ribs are distinct upon the wings, being stronger upon the anterior wing (in the right valve) than upon the posterior. The relative size, demarcation, and ornamen-



tation of the wings seems to be of no value in discriminating groups as a whole, varying much in different species.

The shells having the structures above described are obviously closely related to McCoy's *Aviculipecten*, and they resemble it in so many particulars that the possibility is entertained that the only strong differences which seem to exist may be the result of imperfect observation on McCoy's part. He distinctly says that *Aviculipecten* has no median cartilage pit, and though, as I have elsewhere shown,<sup>a</sup> two apparently distinct types of cardinal structure are ascribed to that genus by different authors, all agree in repeating this character. I do not feel justified, therefore, in referring to *Aviculipecten* shells having a large and obvious excavation for the resilium, though the name *Limipecten* is only proposed conditionally on *Aviculipecten* having the characters which on every hand it is said to have. As previously remarked, the strong resemblance otherwise shown between the two genera leads me to believe that *Aviculipecten* really does possess a cartilage pit, a belief which finds support in the fact that De Koninck apparently describes and figures this structure in one of McCoy's species all along supposed to belong to *Aviculipecten*. The fact that Meek observed this fossette in *A. occidentalis* without considering it of sufficient importance to warrant removing the species from *Aviculipecten*, is of some interest; but if it should prove that a persistent group of species possesses the cartilage pit, while another is persistently without it, it may well be doubted whether he would still have included both types under *Aviculipecten*.

The presence of a cartilage pit is the most important character that distinguishes *Limipecten* from *Aviculipecten* as defined by McCoy, which the new genus much more closely resembles than it does the description of the hinge plate given by Woodward and copied by many succeeding writers. It will be observed that McCoy figures the hinge plate of *Aviculipecten* as broadly triangular in shape, with its longest side uppermost. The upper margin of *Pecten* also is straight, indicating in both cases, I would judge, that this was the true hinge line, and that the resilium and cartilage are internal. In *Limipecten*, however, the triangular hinge plate has its base downward, the striations due to growth being rectilinear and parallel to the lower margin, which seems to indicate that the real hinge line was along the base of the hinge plate, and that the cardinal structures are external. This is also shown by the conspicuous gaping of the valves above when they are closed, their line of contact being the lower margin of the hinge plate.

It appears to me that the name *Aviculipecten* is a misnomer so far as it indicates that these shells are at all closely connected with the Aviculidae (Pteriidae), and this is especially the case if *Limipecten*

<sup>a</sup>American Geologist, XXXIII, May, 1904.

proves to be the same as *Ariculipecten*. That the real affinities of *Ariculipecten* are with the Pectinidae seems now to be generally accepted, and the position of *Limipecten* is clearly in the same group. Meek has suggested the propriety of discriminating *Ariculipecten* and its allies from the Pectinidae as a separate family or subfamily, and it certainly seems that such a course would give greater unity to both groups.

Although Woodward appears to have questioned the validity of *Ariculipecten*, its distinctness from *Pecten* is now generally recognized. *Limipecten*, though presenting one additional and striking point in common with *Pecten*, is also certainly distinct. It has a large hinge plate, with an external, instead of an internal, resilium and cartilage, and the shell structure is probably different. *Limipecten* is, in fact, in many respects more closely related to *Lima* than to *Pecten*, as it has the cardinal structure of *Lima*, with the general expression of *Pecten*. The strongly inequivalve shell in *Limipecten*, its broad wings, and its composite shell structure, if, as is surmised, it has an inner nacreous as well as an outer tubuli-fibrous layer, prevent the reference of these shells directly to *Lima*. If anything, it seems to me that *Ariculipecten* and *Limipecten* belong rather to the Limidae than to the Pectinidae, though they do in a measure combine the characters of both families. Meek's suggestion of separating this group as a distinct family or subfamily seems, therefore, to be a good one, and is also enforced by the shell structure of *Limipecten*.

In a recent paper<sup>a</sup> I have proposed the name *Acanthopecten* for the peculiar and well-known species *Ariculipecten carboniferus* Stevens. I am now able to add a few facts regarding this form which go still further to validate its separation from *Ariculipecten*. Meek has called attention to the fact that the shell in this species is thin, that it seems to consist of a single layer, and that it appears to have a prismatic structure. Basing my observations apparently upon the same material from Nebraska which formed the subject of those of Meek, all of these facts are indicated, though I hesitate regarding the prismatic structure of the shell. This is, to be sure, suggested by its appearance under the microscope; but I doubt if this structure was really present. The shell substance seems to be minutely granulate, instead of prismatic, and possibly is not the original material at all, but a crystalline infiltration. The film preserved is so thin that it is difficult to determine whether the appearance is due to granules or prisms, but from their great variety in size and shape, their very minute dimensions, and their general appearance, I believe that they are grains or crystals of calcite.

Along the hinge line the shell is rather strongly elevated into a narrow cardinal ridge, which appears on the inside as a groove. In this

<sup>a</sup> U. S. Geol. Surv., Prof. Paper, No. 16, 1904, p. 417.

doubtless the ligament was accommodated. This groove narrows to a line at the beaks, and I doubt if there was any excavation at that point for the resilium. As the posterior ear is considerably larger than the anterior, the ligamental groove is much more distinct than on the anterior ear. Mention may also be made of a fact, not before recorded so far as I am aware, the presence of a row of small, erect spines along the cardinal line. As yet these have been observed only upon the anterior ear, but they may possibly have existed upon the other also. In the apparent absence of a median pit this form suggests *Ariculipecten*, but there is no hinge plate, and the ligamental furrow, in contrast to the hinge plate of either *Ariculipecten* or *Limipecten*, narrows toward the umbones and widens toward the extremities of the wings. The cardinal and superficial characters of this form, and the shell structure, if it has but one layer, and especially if it is prismatic, as Meek believed, satisfactorily discriminate the genus *Acanthopecten*.

PLEUROPHORELLA, new genus.<sup>a</sup>

This term is proposed primarily for a new species of pelecypod shell from the Pennsylvanian rocks of Texas, but to the same group probably belong several species already in the literature. While the genotype, though possessing many characters in common with King's genus *Allerisma*, has several striking peculiarities, the other allied forms to a certain extent bridge over these differences. The specific description of *Pleurophorella papillosa*, and the discussion following it, will give the characters of these shells in more detail, but it seems proper to indicate at this place the most important features of the genus, which are external, those of the interior being unknown. The shape is transversely elongate, subrectangular; the hinge line long; the valves probably in contact throughout. The lunule and escutcheon are sharply defined, the former more or less strongly concave. The shell is thin, the superior-posterior portion with a few radial costæ, the remainder marked by concentric plications, which die out more or less completely at the umbonal ridge. The surface is granulose or papillose, the granules tending to an arrangement in radial lines, and sometimes connected into liræ. The chief difference between these shells and those grouped under *Allerisma* which can be at present pointed out are the more sharply defined and more strongly depressed lunule and the presence of costæ, the development of which results in a truncation of the posterior outline.

Genotype.—*Pleurophorella papillosa*.

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<sup>a</sup> From *Pleurophorus*, a Pelecypod genus.



## PLEUROPHORELLA PAPILLOSA, new species.

Plate XLV, figs. 4, 5, 6; Plate XLVI, fig. 5.

In general appearance this form much resembles species of the genus *Pleurophorus*. The size is somewhat above the average, the shape transversely elongate, with the width about twice the height. The point of the umbo is situated but a short distance posterior to the front end of the shell. The upper and lower margins are subparallel. The hinge line is straight and occupies about two-thirds the entire width. The lower margin is gently convex, turning upward rather strongly at the anterior end, the outline of which is truncated for about half the height. The posterior end is also truncated by an oblique line, making an obtuse angle with the upper and an acute angle with the lower margin. In perfect specimens the posterior truncation is itself more or less complex or interrupted by the development of ribs upon the shell. The posterior outline is not normally strongly oblique, but in old specimens, through being worn or broken, it merges more or less with the cardinal outline and extends strongly backward, making the inferior-posterior angle sharply rounded. The convexity is considerable, and is the same in both valves. It is greatest toward the front, diminishing markedly toward the posterior end. The anterior end is strongly concave, forming what may be termed an introverted lunule. The junction of the retreating and advancing portions of the shell is acutely angular. The introversion of the anterior end produces a more or less distinct truncation of the outline. Extending diagonally from the beak to the inferior-posterior angle is a well-marked ridge or angulation, and a second fainter ridge runs midway between it and the hinge line. Here again the shell is inflexed, forming a sharply defined elongate area upon both valves. These areas in the two valves are nearly horizontal, making together an obtuse angle, which opens outward, and, doubtless, accommodated a large external ligament.

The surface is marked by fine concentric striae and large low plications, the whole being minutely and elegantly papillose. The concentric markings, especially the more prominent ones, become more or less suddenly and completely obsolete at the umbonal ridge. The shell is thin, but nevertheless seems to consist of two layers. The outer, which carries the papillose surface ornamentation, sometimes exfoliates or wears off, leaving the underlying portion smooth but for the concentric striae and wrinkles.

The dentition and pallial and muscular markings are unknown. One specimen, it is true, seems to show a single dental socket under the beak of the left valve, but I am not quite satisfied as to the origin and function of this depression.

Cat. No. 27140, U.S.N.M.

*Locality and horizon.*—Pennsylvanian (Cisco), Graham, Young County, Texas.

Aside from the typical species, whose characters have been detailed above, there can probably be referred to *Pleurophorella* several forms resting at present with different generic groups. One, a species possessing many of the essential characters of *Pleurophorella*, was described as *Allerisma? gilberti* White. This author neglects to mention the presence in this species of a depressed lunule and of a strongly marked ligamental area. The surface, furthermore, is marked by granules arranged in radial lines and having the appearance of delicate liræ. While the lunule in this species is depressed, it is not nearly so deeply concave as in *Pleurophorella papillosa*. Another species, less perfectly known than *Allerisma gilberti* but without much doubt belonging to the same generic group, is *Allerisma geinitzi* Meek. On account of the preservation of the type of this species many of the parts shown in *Allerisma gilberti* are concealed. *Allerisma reflexum*, which appears from Meek's figures to be very closely related to *Allerisma gilberti*, probably does not belong here, the type specimen being very imperfect and Meek's figure possibly misleading. *Allerisma costatum* of Meek and Worthen, which is so similar to *Pleurophorella papillosa* that one species might possibly be mistaken for the other, belongs, it is very probable, to the same group, and *Allerisma lanceolatum* Swallow also is a possible representative of *Pleurophorella*, although the description, which is unaccompanied by figures, permits no more than a surmise upon this point.

The incongruity of some of the forms referred by American authors to *Allerisma* has been remarked even by Europeans, and I find that Wheelton Hind has rejected several American species originally referred to King's genus. Among these is *Allerisma hannibalensis* Shumard, long since transferred to *Grammysia*. By an oversight it would seem he accepts the original description of *Allerisma costatum* Meek and Worthen as a true member of the genus, and rejects the republication in 1873 and also a later identification from Ohio. As the later descriptions were accompanied by figures, which were lacking to the original one, the rejection of this species probably represents his best founded opinion. He also rejects *Allerisma pleuropistha* Meek, *Allerisma winchelli* Meek, and *Allerisma ventricosum* Meek. *Allerisma illinoisense* Worthen is likewise thrown out, and either *Allerisma andrewsi* or *Allerisma marvillense*—of the two without much doubt *Allerisma andrewsi*.

Hind's rejection of *Allerisma costatum* is of importance to me because of the similarity of that species to the type of *Pleurophorella*; and in connection with the relationship of *Pleurophorella* to *Allerisma*. He neither excludes nor includes the other species which at present seem to be appropriately assigned with *Allerisma costatum* to the genus *Pleurophorella*. Relieved of these forms and those mentioned by Hind, one of which, however, can possibly be retained in

*Allerisma*, the American group of *Allerismata* regains somewhat greater homogeneity. Some species can with safety be retained in the genus, as, for example, *Allerisma terminale*, *Allerisma subcuneatum* (= *Allerisma terminale*), *Allerisma capax*, *Allerisma elongatum*, *Allerisma andrewsi*, *Allerisma claratum*, *Allerisma marvillense*, and *Allerisma sinuatum*. Several forms aside from those withdrawn under *Pleurophorella*, can be almost certainly rejected, e. g., *Allerisma cooperi*, *Allerisma grauosum*, *Allerisma curtum*, *Allerisma latum*, *Allerisma pleuropistha*, *Allerisma ventricosum*, and *Allerisma winchelli*. The position of the remaining forms seems to me more or less doubtful. A few will probably remain with *Allerisma*, but the major portion will probably bring up elsewhere. The figures in many instances are suggestive of *Sphenotus*.

The type species of *Pleurophorella* is so unlike a typical *Allerisma* such as *Allerisma subcuneatum* (= *Allerisma terminale*) that the possibility of their belonging to the same genus seems at first very remote. It was in fact some time before I recognized the affinity which almost certainly exists between *Pleurophorella* and *Allerisma*. I am at present not sure that the former should hold the position of more than a subgenus. Both are transversely elongate in form, both have a shell marked with papillæ and by concentric folds, both have lunule and escutcheon fairly strongly marked. The lunule in *Pleurophorella papillosa* is not only sharply defined but retreats inward to such an extent that in a full-grown specimen the anterior end is concave by as much as 6 mm. The lunule is strongly marked and depressed in *Pleurophorella gilberti*, but to no such marked degree. It is a distinct feature of *Allerisma subcuneatum*, but is not very sharply defined and is not concave. The surface of *Pleurophorella papillosa* is finely papillose, with some tendency toward arrangement in radiating lines. In *Allerisma subcuneatum*, and I believe in *Allerisma* generally, the granules are coarser, much more scattering, and more linear in arrangement. One character which seems to be constant in *Pleurophorella* but is never found in *Allerisma* so far as I am aware, is the presence of one or more costæ on the upper posterior portion of the shell, a feature which gives much individuality of expression to the former genus. It is to be regretted that the interior structures of *Pleurophorella* are up to the present unknown, but those of an external character are sufficiently marked to make me look rather confidently for corresponding differences upon the inside of the shell. The costate condition and general expression of *Pleurophorella* are very suggestive of another altogether different group, and *Pleurophorella papillosa* in particular much resembles *Pleurophorus tropidophorus*, or even *Pleurophorus occidentalis* and *Pleurophorus angulatus* but the resemblance is only superficial. *Pleurophorus* has neither the papillose surface nor the impressed lunule of *Pleurophorella*, while if the latter is, as I feel little doubt, related to *Allerisma* the internal structures are distinctly different.

Among the species described as *Allerisma* which probably belong with *Pleurophorella papillosa*, none is nearer than *Allerisma costatum*. I have no specimens of that species with which to make direct comparison, but Meek's description shows the following differences, though the resemblance is so marked that but few can be pointed out. The concentric folds in *Pleurophorella papillosa* are not so strong or so regular, and the lunule is apparently more deeply concave, for Meek only mentions this feature casually in *Allerisma costatum*, while it could not but be the subject of more particular comment if it were anywhere near as deeply indented as in the Texan form. The latter is likewise not so elongate transversely nor does the anterior end project so strongly.

#### CLAVULITES<sup>a</sup>, new genus.

In the Burlingame shale at Howard, Kansas, occurs an interesting little shell whose resemblance to the Dentaliidae is rather striking, and yet some of whose characters are so peculiar as to warrant its consideration as a genus distinct from any at present referred to the family. But a single species is known.

*Clavulites* is founded upon a small, curved Dentalioid shell resembling the *Plagioglypta* section rather than *Dentalium* in the strict sense. The surface is marked by fine, flexuous, obliquely transverse liræ, as in *Plagioglypta*; but the character of especial importance is the presence on the concave (dorsal) side of a linear ridge or callosity over which the liræ pass with a strong anterior deflection. It is difficult where, as here, but a single species is known to distinguish between the strictly generic and specific characters, but it is probable that the annulated surface and the dorsal callosity will remain the distinctive generic characters of *Clavulites*.

Genotype.—*Clavulites howardensis*.

#### CLAVULITES HOWARDENSIS, new species.

Plate XLVII, figs. 4, 5, 6, 7, 8, 9, 10, 11.

Shell small, rapidly tapering, often strongly curved. Cross section circular. Along the dorsal or concave side the shell is thickened into a linear welt or ridge, which varies in prominence in different individuals, but is always present and always dorsal. The callosity is not altogether due to a thickening of the shell, however, because it can sometimes be detected upon internal casts.

This structure was doubtless produced by a lobe of the peristome quite different from anything known in *Dentalium*, and represents differences in organization sufficiently marked to show that *Clavulites* should be considered a distinct genus, and possibly the representative of a distinct family. The surface of *Clavulites howardensis* is crossed by regular, subequal, flexuous, obliquely transverse liræ. Upon the

<sup>a</sup> From *clavulus*, a little nail or tack.



ventral side of the shell these markings appear almost directly transverse, or are slightly bowed, with the convexity toward the smaller end. At the sides they assume a strong forward direction, and are still further flexed in passing over the dorsal callosity. In one or two specimens I have noticed a very slight serial sinuosity, repeated by each lira, as it passed from the ventral side of the shell, but I am not sure that this is more than an individual characteristic. The liræ are, moreover, faintly crenulated or serrated, so that the repetition of these minute projections sometimes lends to this specimen or to that the appearance of having fine, indistinct longitudinal lines.

The question might pertinently be raised whether *Clavulites* is a true Scaphopod, and whether it is not, like several other reputed *Dentalia*, a worm tube or other exuvia. As the shelly matter of these specimens has been replaced by pyrite, they are unfavorable for sectioning to determine by means of the microscope their minute structure. This class of evidence can not, therefore, be considered. Some of the Serpulidæ grow singly, as is well known, and have one or more longitudinal ribs similar to *Clavulites*, but the uniformity of size, shape, and curvature in *Clavulites*, and the unvaried location of the callosity upon the dorsal side, is strong evidence against any affinity with the worms. Professor Pilsbry, whose opinion has been consulted regarding *Clavulites*, has suggested as a possibility that this genus may be related to *Hyalithes* or to the *Conulariida*. These suggestions are worthy of consideration, but against this relationship may be urged the facts that *Hyalithes* is rarely circular in section and *Conularia* never curved. *Clavulites* presents more characters comparable with the recently described genus *Enchostoma* than with *Conularia* itself. Both the genera last mentioned are characterized by their bright, glossy, phosphatic shells, which strongly resist solution, and probably, also, replacement. The fact that my specimens of *Clavulites* are pyritized, therefore, may be considered as negative evidence in estimating the possibility of an affinity of that genus with either *Enchostoma* or *Conularia*. Could all three genera be secured from the same bed, where they had been subjected to the same conditions, evidence of this nature would be more conclusive than that furnished by existing conditions.

From all the facts available, however, it appears much more probable that *Clavulites* is allied to *Dentalium* than that it should be associated with any of the other genera discussed.

A singular circumstance which almost invariably attends the preservation of the specimens examined is that the larger end is embedded in a pyritiferous concretion. This condition is shown in several of the specimens figured.

Cat. No. 35134, U.S.N.M.

*Locality and horizon.*—Pennsylvanian (Burlingame shale), Howard, Kansas.



SCHUCHERTELLA,<sup>a</sup> new name.

This term is proposed for shells having the type of structure for which the name *Orthotetes* is at present in use. That generic name, which there is no authority for spelling otherwise than *Orthotetes*, was introduced by Fischer-de-Waldheim early in the last century, but the term was not generally taken up and was but little used, save on several occasions by its author, until Waagen revived it in 1884. That author, changing for some reason the spelling to *Orthothetes*, subsumed under the name, as is well known, a group of Streptorhynchoid shells which was without a septum or extended dental plates in the ventral valve, and in which the socket walls were not produced so as partially to surround the muscle scars in the dorsal. A careful study of Fischer-de-Waldheim's early descriptions and figures must convince anyone that the type of structure with which the name *Orthotetes* must be associated is that for which Waagen introduced the name *Derbya*. Thus *Derbya* becomes a synonym for *Orthotetes*, and the latter name becomes dissociated from the structural type for which it is now in use and transferred to a different but related one. For the shells now left without a generic name by the removal of *Orthotetes*, the term *Schuchertella* is proposed. As here used this name is primarily employed for a group of shells which attains its climactic development in late Devonian and early Mississippian time. The genotype selected is *Streptorhynchus lens* White, from the Louisiana limestone, a form which is abundant and well preserved, and of which excellent figures, both of external and internal features, have been published by Hall and Clarke.<sup>b</sup> In a report now under preparation, on the Guadalupian fauna, this subject is discussed in detail in connection with a full quotation of Fischer-de-Waldheim's different descriptions and figures. As it is uncertain when this work will receive publication, owing to the difficulty of securing necessary illustrations, it seemed better to introduce the name *Schuchertella* in the present place, along with a condensed discussion of its standing, rather than to perpetuate for several years an incorrect usage.

Genotype.—*Schuchertella lens*.

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<sup>a</sup>This name not only is an expression of friendly regard but commemorates the services of an excellent paleontologist in a group of which he is a master. It is superfluous to say that it is proposed in honor of my friend Mr. Charles Schuchert.

<sup>b</sup>Geol. Surv. N. Y., Pal., VIII, Pt. 1, pl. xia, figs. 16-22.

## EXPLANATION OF PLATES.

## PLATE XLV.

*Limipecten texanus*, p. 722.

The type specimen in which both valves are retained in position.

Fig. 1. Left valve showing the shape and surface characters.

The squamose concentric lines are perhaps a trifle more numerous and closely arranged than shown by the figure.

2. Right valve. Though imperfect, this valve shows how different the surface characters are from those of the left. By a breaking away of the upper portion the hinge plate and cartilage-pit of the other valve are brought to view.
3. Side view of same showing the unequal convexity of the two valves.

*Pleurophorella papillosa*, p. 729.

The type specimen, a full-grown individual which has suffered to some extent from erosion.

Fig. 4. View of the anterior end. The degree to which the introverted lunule extends into the cavity of the shell is hardly strongly enough shown, while the sharp angular outline of the lunular area is by no means exaggerated.

5. Side view showing right valve. Probably owing to erosion or breakage the posterior-inferior angle in this specimen is more acutely angular than normal. The diagonal ridge between the main angulation and the hinge is quite indistinct in the specimen, and in the figure is represented as too near the latter; its real position is intermediate.
6. Specimen seen from above. The escutcheon and the intermediate ridges are shown in this view, and the cavity at the anterior end caused by the depressed lunule.

## PLATE XLVI.

*Limipecten texanus* var. *grandicostatus*, p. 723.

A specimen retaining both valves in conjunction.

Fig. 1. Right valve, showing the fine ribs characterizing this valve.

2. Left valve, showing the large loose folds and lamellose concentric lines.
3. Side view, showing relative convexity of the two valves.

*Limipecten texanus* (?), p. 722.

Fragment of the upper portion of a large massive left valve.

Fig. 4. View of the hinge plate, showing cartilage pit. The broken edge to the left of the figure is just beyond the edge of the cartilage pit, which is therefore represented in its entire dimensions.

*Pleurophorella papillosa*, p. 729.

A young specimen, somewhat more perfect than the type, and, like it, retaining both valves in place.

Fig. 5. Side view of left valve. This specimen shows the manner in which the angular concentric ridges which mark the rest of the surface become suddenly obsolete at the umbonal ridge.

## PLATE XLVII.

*Limipecten texanus*, p. 722.

A specimen somewhat larger than the type, retaining both valves in conjunction.

- Fig. 1. Left valve. The anterior ear is better preserved than in fig. 1 of Plate XLV, and the figure shows how abruptly it is depressed below the rest of the shell. The finer surface ornamentation has been lost by weathering or abrasion.
2. Right valve. The difference in surface ornamentation is well shown.
3. Side view of both valves. The convexity of the left valve has been somewhat exaggerated by fracture, but it is evidently much greater than that of the right. The depression of the anterior ear in this valve (left) and its sharp demarcation from the rest of the shell are clearly represented.

*Clavulites howardensis*, p. 732.

- Fig. 4. Enlargement of an imperfect specimen to show the surface. The ventral side is represented. It did not prove to be practicable to show upon the concentric ridges the crenulations which, by reason of their linear succession, give well preserved surfaces the appearance of being marked by delicate, discontinuous longitudinal line.
5. View of the dorsal side of a specimen in which the callosity is strongly marked.
- 6, 7, 8. Ventral, dorsal, and side views of a strongly curved specimen in which the callosity is faint.
- 9, 10, 11. Dorsal, ventral, and side views of a more nearly straight specimen in which the callosity is again prominent.